PATENT SPECIFICATION 1,131,310

DRAWINGS ATTACHED.

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1,131,310

Date of filing Complete Specification: 16 Feb., 1967.

Application Date: 25 Nov., 1965. No. 50199/65.

Complete Specification Published: 23 Oct., 1968.

Index at Acceptance:—F2 X(8B, 8E, 8S5, 8W); A5 A50; B8 B34.

Int. Cl.:—F 16 g 11/04.

COMPLETE SPECIFICATION.

Safety Device for Arresting Workers at Height, in the Event of a Fall.

We, BARROW HEPBURN & GALE LIMITED, a British Company of Grange Road, Bermondsey, London, S.E.1, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to safety devices for use by workers at height.

More particularly, the invention relates to safety devices for arresting a person in the event of his falling during ascent or descent of a structure.

Various constructions of safety device for quickly arresting a person by a safety line in the event of his beginning to fall are known. Among the devices which permit normal movement of the person from one level to another without movement of the safety line anchorage, are those in which the safety line is coiled on a drum which is secured at an elevated position and automatically locks under the action of centrifugal force in the event of the safety line being suddenly accelerated to a high velocity. Such devices are open to the objection that they are necessarily large and cumbersome if they are to accommodate long safety lines as is sometimes necessary.

In another form of safety device, which is described and claimed in United Kingdom Patent Application No. 1,077,068, the safety line extends through a runner which is attached to the person and locks onto the safety line in the event of sudden acceleration of the person. Such devices are very successful in many fields of use but in others the locking device is too sensitive because the personnel exposed to the risk of falling have in the course of their work necessarily to perform movements which are liable to operate the lock in the same way as does a fall. This difficulty may arise for example if the device is used by a fireman when climbing through a window onto a fire escape ladder or is fitted to a person who is being carried to safety by the fireman.

The present invention provides a solution to this problem.

A safety device according to the present invention comprises a casing which can be connected to a fixed anchorage and through which a safety line can be threaded and drawn, and, housed in said casing, a brake for gripping and arresting the safety line, a member mounted for frictional engagement and rotation by the safety line as it is drawn through the device, and a part which is connected to such rotatable member and which when the speed of rotation of the said member exceeds a certain value, moves relative to said member under centrifugal force and in such movement causes the brake to grip the safety line.

The rotatable member which is driven by frictional engagement by the safety line may be a sheave over which the safety line passes. The part which is displaceable under centrifugal force may, e.g., directly or indirectly bring about relative displacement between line-gripping members and a co-operating wedge means which forces such members inwardly against the safety line. The line-gripping members may be a set of balls carried by a cage through which the safety line passes. Once the balls commence to grip the safety line, the grip becomes more intense as the load on such line increases. The ball cage is preferably displaceable relative to a fixed wedge but it is of course possible to construct the safety device with a movable wedge and a fixed ball cage.

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The safety line can, e.g., be in the form of a nylon rope.

An embodiment of the invention will now be described by way of example with reference to the accompanying diagrammatic drawings in which:

Fig. 1 is a general view of a device according to the invention with a rope threaded therethrough;

Fig. 2 is an elevation of the device partly in section;

Fig. 3 is a sectional view, at right angles to Fig. 2, showing the interior mechanism in locked position; and

Fig. 4 is a view of the rope sheave in section.

The device comprises a generally cylindrical body 1 which in use is suspended from a fixed anchorage by a ring 2. A pulley wheel or sheave 3 is rotatably mounted in the body 1 at a position near its upper end. A rope R leads into the body 1 above the sheave 3, wraps around one half of the sheave and passes downwardly through a central passage in the body. In use, the bottom end of the rope is attached to a safety belt or harness worn by a worker at height and as he descends the sheave 3 is rotated by virtue of its frictional engagement by the rope.

The body 1 comprises a tubular metal casing in which are fitted a cap piece 4, a base plug 5 and an upper rope guide 6, these three components being moulded from Nylon. The parts 4 and 6 constrain the rope to maintain engagement with the sheave over half its periphery and part 6 is shaped to prevent the rope from being threaded through the device in such a way as to follow the right-hand side of the sheave in the aspect of Fig. 2.

Within the body 1, below the upper rope guide 6, is a ball cage 7 carrying a series of steel balls 8, each of which are apparent in Figs. 2 and 3. The ball cage floats in the body and is normally held in the raised position shown in Fig. 2 by a helical spring 9.

The sheave 3 forms the input member of a centrifugal clutch. Referring to Fig. 4, the sheave, which is rotatably mounted on shaft 10, comprises a moulded Nylon rim portion 11 fixed to a flanged disc 12 defining a central cavity. A second disc 13 constituting the output clutch member is mounted on the same shaft 10 so as to be freely rotatable relative to the unit 11, 12. On one side of disc 13 it carries, at diametrically opposed regions, two arcuate bosses 14, 14*a* which extend into the cavity defined by the flanged disc 12. The other side of disc 13 carries two studs 15, 15*a*. The said cavity within the sheave also houses an arcuate weight 16 which is pivoted near one end thereof to the diametral wall of disc 12. The actual pivot axis is located behind shaft 10 in the aspect of Fig. 4. During rotation of the sheave in the direction denoted by the arrow in Fig. 1 the free end of weight 16 tends to swing outwardly under centrifugal force. Such outward movement is opposed by a spring (not shown) extending between the weight 16 and the disc 12 so that the weight is held in until the speed of rotation of the sheave exceeds a certain value. At speeds in excess of that value the centrifugal force overcomes the spring loading of the weight and the free end of the weight moves radially outwardly into abutment with one of the arcuate bosses 14, 14*a* on the disc 13. The disc is then instantly turned with the sheave.

As soon as the disc 13 begins to turn, one of the studs 15, 15*a* on this disc is forced against the head of a brake-actuating rod 17 which extends through a vertical guide passage in the upper rope guide and rests on the top of the ball cage 7 as appears in Fig. 3. This actuating rod 17 is situated in front of the section plane in Fig. 2 but the head of the rod is shown in broken line in that figure, in the position which the rod occupies prior to displacement by the clutch disc 13. As appears in Fig. 2, the head portion of the brake-actuating rod presents a sloped edge face to the studs 15, 15*a* on the clutch disc 13 so that when this disc is driven the rod 17 is cammed downwardly and downwardly displaces the ball cage 7, against the action of spring 9. Fig. 3 shows the ball cage 7 in its bottom position. As the ball cage is depressed, the balls 8 run along the tapering conical face of a wedge 18 which causes the balls to move radially inwards and to exert a powerful grip on the rope.

The base plug 5 in the illustrated device can constitute or incorporate a damper which exerts a slight frictional grip on the rope as it pulls through the device and thus prevents momentary unlocking of the device due to any bouncing of the loads which may occur.

The length of the rope can be chosen entirely to suit particular requirements without necessitating any change in the dimensions of the safety device which can be in all cases conveniently small.

The centrifugual clutch can be designed to permit the user to move freely at speeds up to say 5 m.p.h. Should the user during descent from height, slip and fall, he can be arrested by a device as illustrated after a free fall of approximately 2 feet. The use of a Nylon rope, combined with the illustrated locking system, ensures that only a small portion of the falling shock is transmitted to the user.

The provision of one stud 15 or 15*a* would suffice, but it is better to provide two angularly spaced studs as this reduces the

amount of fall if one stud passes the actuating rod just short of sufficient acceleration to operate it.

WHAT WE CLAIM IS:—

1. A safety device for arresting a person working at height, in the event of a fall, comprising a casing which can be connected to a fixed anchorage and through which a safety line can be threaded and drawn, and, housed in said casing, a brake for gripping and arresting the safety line, a member mounted for frictional engagement and rotation by the safety line as it is drawn through the device, and a part which is connected to such rotatable member and which when the speed of rotation of the said member exceeds a certain value, moves relative to said member under centrifugal force and in such movement causes the brake to grip the safety line.

2. A safety device according to claim 1 wherein the line brake comprises a set of balls and a wedge which forces the balls into line-gripping position when the line brake is actuated.

3. A safety device according to claim 2 wherein said balls are mounted in a cage which is displaceable in said casing, relative to said wedge, and wherein said cage is normally held in line-release position by a spring.

4. A safety device according to any preceding claim wherein said member mounted for frictional engagement and rotation by the safety line is a sheave against which the safety line bears as it is drawn through the device.

5. A safety device according to claim 4 wherein said sheave constitutes the input member of a centrifugal clutch incorporating a weight which is pivoted to such member and which when subjected to centrifugal force in excess of a certain value, abuts and transmits turning motion to an output clutch member controlling the line brake.

6. A safety device according to claim 5 wherein rotary motion of said output clutch member causes displacement by cam action of a linearly displaceable brake-actuating member.

7. A safety device substantially as herein described with reference to the accompanying drawings.

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For the Applicants.

Printed for Her Majesty's Stationery Office by Burgess & Son (Abingdon), Ltd.—1968.
Published at The Patent Office, 25 Southampton Buildings, London, W.C.2,
from which copies may be obtained.

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1 SHEET This drawing is a reproduction of the Original on a reduced scale

FIG.1.

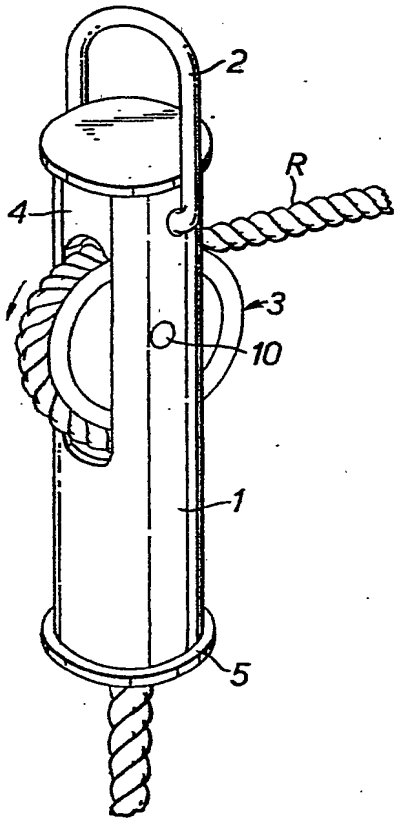

FIG.2.

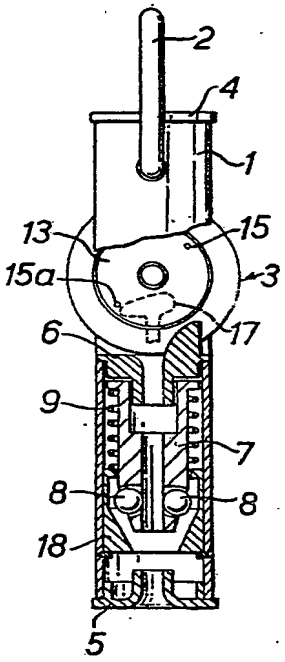

FIG.3.

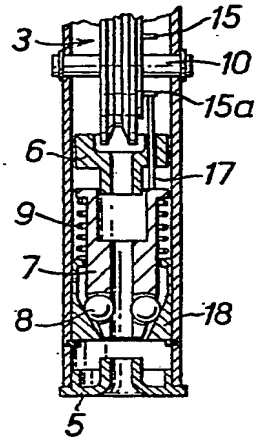

FIG.4.